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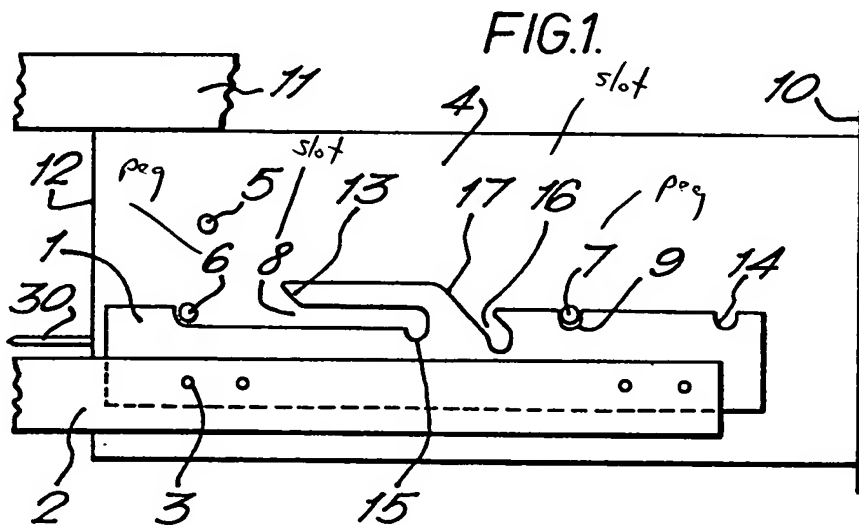
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- (54) Rack mounting system for electrical or electronic apparatus**

- (57) A rack mounting system for mounting electrical or electronic apparatus on the telescopic slides of an equipment rack comprises a respective support plate 1 attached to each slide 2 and a plurality of pins.**

pulleys, rollers or the like 5, 6, 7 carried by the apparatus. The support plate 1 is formed with a slot 8 terminating in the notch 15, notches 16, 9, 14 and an inclined ramp edge 17 leading up to a tongue 13. The pins or the like run along the edges formed on the support plate 1 so that the electrical apparatus is held in one of at least three stable positions, the retracted position shown in the figure, a position in which the front panel 10 is lowered and the rear panel 12 is accessible, and a position in which the front panel 10 is raised. A guide 11 may limit upward movement of the electrical apparatus. The apparatus may be lifted free of the slides in at least one position to facilitate removal.



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FIG. 1.

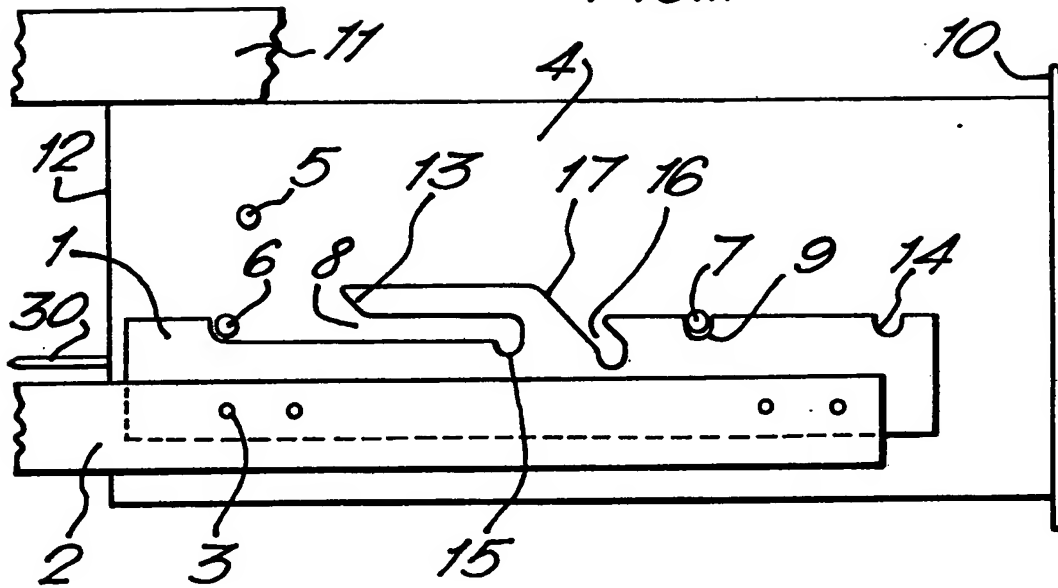
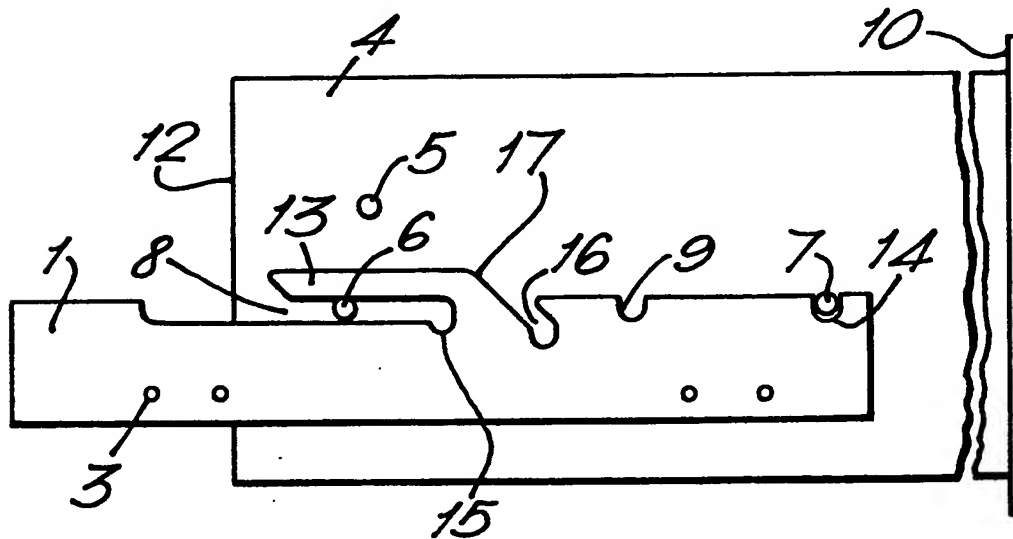
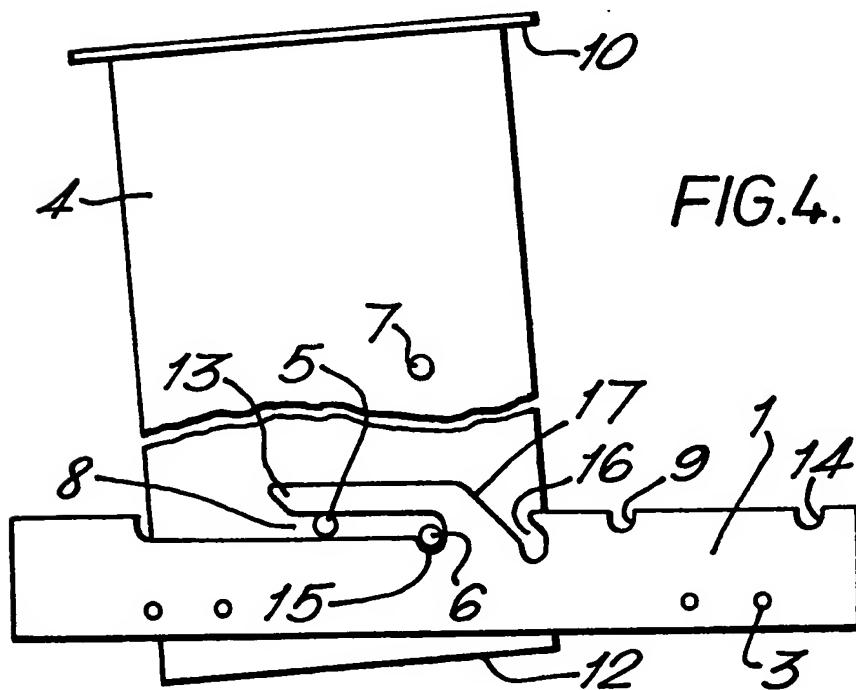
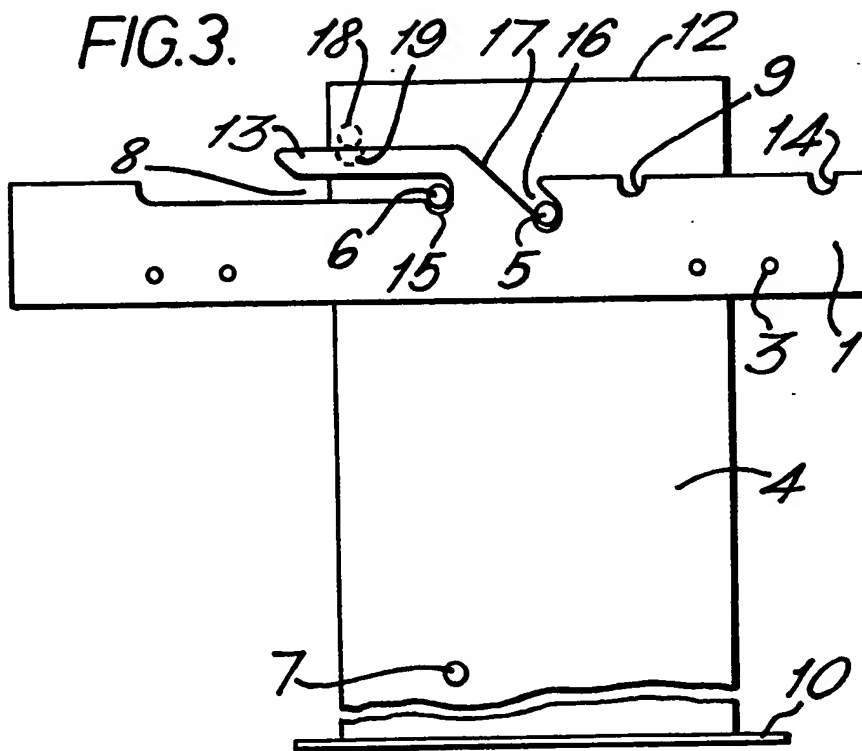


FIG. 2.



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FIG.5A.

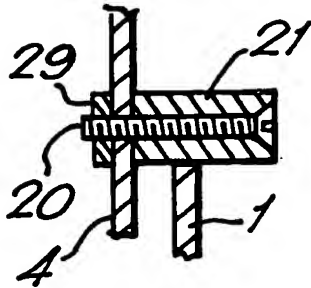


FIG.5B.

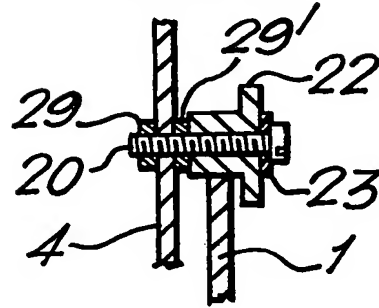


FIG.5C.

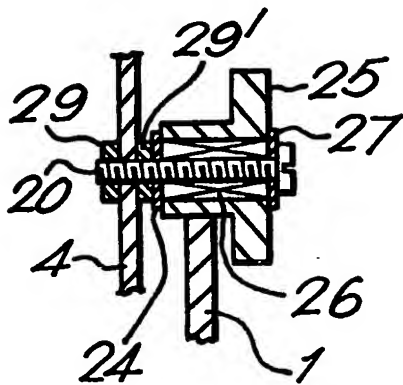
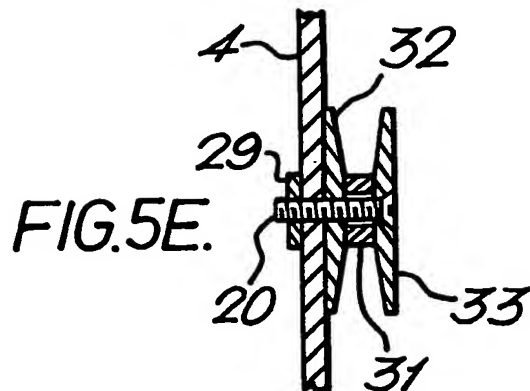
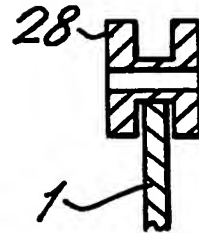


FIG.5D.



SPECIFICATION

Rack mounting system

This invention relates to the mounting of chassis or cases of electrical or electronic

5 equipment in racks or larger cabinets, usually on telescopic slides or runners which allow the apparatus to be withdrawn from the rack for servicing.

The use of telescopic runners or slides, for
10 example those described in US patent 3,771,849, whilst facilitating the withdrawal of the apparatus from the rack, does not allow unrestricted access to the apparatus because the orientation of the apparatus relative to the rack remains unchanged.
15 Furthermore, unless expensive and complicated telescopic slides containing more than two sliding members are used, the apparatus cannot be withdrawn completely clear of the rack to allow easy access to its rear panel unless the apparatus
20 case is significantly shorter than the depth of the rack, which is clearly wasteful of space in the rack. One way of overcoming these difficulties, whilst using only simple telescopic runners is described in UK patent specification 587,598, which
25 discloses the horizontal slotting of the sides of a chassis and the mounting of the chassis on the slides by means of a pair of locating pins attached to the slides which engage with the slots in the chassis sides. This allows the chassis to be moved
30 forward on the locating pins once the slides have been fully extended, and allows easy access to the rear of the apparatus. By means of a suitable shaping of the pins and slots, and the provision of a pair of locking catches, the chassis is made to
35 pivot on the slides when it is withdrawn fully, so that it hangs with its front panel uppermost and horizontal, which permits easier access to the underside of the unit.

Another approach involves the mounting of the
40 apparatus on fixed pivots on the telescopic slides and locking it in position in various orientations with ratchet and pawl devices, e.g. as disclosed in UK patent specification 902,045. This method does not improve access to the rear of the unit
45 when it is horizontal, however, although it does permit the apparatus to be locked in many different orientations on the slides. Clearly, pivots associated with any locking device can also be used. The provision of pivots of any description,
50 however, usually makes it difficult to completely remove the chassis from the slides because this will require the dismantling of the pivot assembly.

This problem detracts from the usefulness of telescopic slides in general, because it is
55 frequently necessary to remove an item of equipment from the rack, for example to replace it with another item whilst a fault on the original equipment is corrected elsewhere. It is also often necessary to withdraw the apparatus so that its
60 rear panel is well clear of the rack, for example to carry out adjustments whilst the equipment remains connected to the rack, and this is impossible with the simple pivoting systems, unless multiple telescopic slides are used. It is not

65 usually necessary, however, to provide a large number of different orientations for the apparatus on the slides, and for most applications only one or two are needed. However, it is important that the apparatus is held securely in these positions
70 whilst servicing or adjustments are carried out.

It is the object of the present invention to provide a simple method of mounting electrical apparatus on telescopic slides or the like, in such a way that the apparatus can easily be removed
75 from the slides when necessary, or can be moved forward beyond the maximum extension of the slides to give improved access to its rear, or can be positioned in one of several orientations on the slides to allow easy access to its top or bottom.

80 In accordance with this objective, there is provided a rack mounting system for securing electrical apparatus to a pair of telescopic slides or the like, comprising a pair of rigid elongated support plates forming part of or attached to the
85 sliding members of the telescopic slides, said support plates being provided with a plurality of slots and notches opening into the upper edge of the plate, and positioned in such a way as to simultaneously receive and locate two out of a
90 plurality of pins, pulleys or rollers carried by said electrical apparatus and said notches, slots and pins, pulleys or rollers being positioned so as to allow the said apparatus to be positioned in a plurality of orientations on said support plates
95 once the telescopic slides have been extended, and maintained in these orientations through the action of gravity so that the apparatus can only be moved from the selected orientation by a deliberate lifting action, thereby improving access
100 to the apparatus whilst it remains on the telescopic slides, by allowing the easy removal of the apparatus from the slides in at least one of the orientations simply by lifting the said pins or the like out of the said slots and notches.

105 The said pins, pulleys or rollers may be further provided with flanges in order to prevent the said support plates from moving away from the said electrical apparatus which would allow the apparatus to fall between the support plates. By
110 this means, the need for a framework to hold the support plates in the proper position is eliminated. Furthermore, the positions of the said pins or the like and said notches and slots are arranged so that the various orientations of the apparatus can
115 be obtained in sequence simply by lifting the front of the apparatus so that it remains supported on only one pair of pins and rollers, and then moving it so that these pins or rollers slide along an edge of the support plate into the next desired location,
120 so that there is no need to lift the apparatus off the support plates to change its orientation.

The pins or the like may be carried by a framework of the electrical apparatus or by brackets, but preferably the apparatus is provided
125 with side plates and the pins or the like are mounted on the side plates.

A possible embodiment of the invention will now be described in more detail by way of example and with reference to the accompanying

drawings, in which:

Figure 1 is a side elevation showing the position of the apparatus on the support plates when it is inserted in the mounting rack;

- 5 Figures 2, 3 and 4 are similar views showing three possible positions of the apparatus on the support plates when the slides have been extended;

- 10 Figures 5A, B, C, D and E show different forms of construction of pins, pulleys or rollers suitable for use in the invention; and

- 15 Figures 6 and 7 give the essential relationships between the positions of the pins and notches etc, which are required for the proper operation of this embodiment.

- Referring first to Figure 1, an elongated support plate 1 is attached to the sliding member of a telescopic slide 2 by means of four countersunk head screws in holes 3. Slide 2 may be of any
20 known type, but those which can be locked in their fully extended position are particularly suitable. A plate-like member 4 either forms the side of the case of the apparatus or is attached to it, and carries three pins or rollers 5, 6 and 7. The front of the apparatus is indicated by 10. A similar
25 arrangement is provided on the other side of the apparatus. In its normal position on the slides, the apparatus is supported on pins 6 and 7 which located at the end of slot 8 and in notch 9
30 respectively. The apparatus can be withdrawn from, or inserted into the rack on the telescopic slides 2 by means of handles on front panel 10, because the location of pin 7 in notch 9 prevents relative movement in this direction between
35 support plate 1 and plate 4.

- The weight of the apparatus maintains pins 6 and 7 and slot 8 and notch 9. When the unit is in position in the rack, the front panel 10 is secured to the rack by releasable devices such as stout
40 screws or catches. The rear panel 12 of the apparatus carries a number of dowels 30 which locate in suitable sockets fixed in the rear of the rack. These prevent the apparatus from being dislodged from its mountings on the support
45 plates by shock or vibration. In order to eliminate the risk of pins or pulleys shearing off under extreme conditions, the front panel securing screws and the sockets for dowels 30 are positioned so that the apparatus is lifted slightly
50 higher when it is secured in the rack than its rest position on support plates 1. This ensures that pins 5, 6 and 7 are relieved of the weight of the apparatus when it is in the rack, and reduces the chance of damage by shock.

- Alternatively, for less demanding applications, a
55 simple guide 11 may be fitted in the rack above the upper edge of plate 4, to ensure that pin 6 cannot lift out of slot 8. It might conveniently form part of the telescopic slide assembly used for mounting another piece of apparatus above the
60 one indicated. In many cases, however, especially where the equipment rack is fixed in position, neither dowels 30 nor guide 11 are necessary.

- In order to service the apparatus, the devices
65 securing the front panel are released and the

apparatus is withdrawn from the rack using the handles on panel 10. If the apparatus is to be removed from the rack, it may then be lifted clear of the supports 1, as can be seen from Figure 1.

- 70 However, if this is not done, the rear of the apparatus 12 will occupy approximately the same position that the front panel 10 did before the apparatus was withdrawn. Access to the rear panel 12 can be improved by lifting front panel 10 so that pin 7 is lifted out of notch 9 and drawing the apparatus forward so that pin 6 slides along the bottom of slot 8 under tongue 13, and pin 7
75 locates in notch 14. This position is illustrated in Figure 2, in which the telescopic slides 2 are omitted for clarity. In this position, pin 6 is located under tongue 13, preventing the rear of the apparatus being lifted out of slot 8 and improving the security of the mounting.

- In order to gain access to the top of the unit, the front panel 10 is again lifted so that pin 7 is clear of notch 14, and the apparatus pulled further forward until pin 6 locates in notch 15 at the end of slot 8. The front of the apparatus can then be lowered so that it takes up the orientation shown in Figure 3, and pin 5 enters slot 16, preventing further movement. The rear panel 12 is then
90 uppermost.

- To gain access to the underside of the apparatus, the front panel 10 is lifted so that pin 5 leaves slot 16 and runs along the edge 17 to take up an intermediate position 18 (Figure 3). The front panel 10 will then be uppermost, but the apparatus will not be particularly stable because it is leaning forward. A notch 19 may be included in the upper edge of tongue 13 to improve the
100 stability, but it is more satisfactory to slide the apparatus backwards so that pin 6 moves back along slot 8 and pin 5 moves over the entire upper edge of tongue 13 to drop into slot 8. The apparatus can then be moved forward again to return pin 6 into notch 15, simultaneously locking pin 5 in slot 8 under tongue 13, as shown in Figure 4.

- To restore the apparatus to its original position, it is only necessary to lift pin 6 out of notch 15 and slide it backwards until pin 5 clears tongue 13, and then downwards and backwards so that pin 6 moves to the rear of slot 8 and pin 7 enters notch 9.

- 115 It is preferable to use telescopic slides which can be locked in their fully extended position, otherwise attempts to replace the apparatus into the position illustrated in Figure 1 might result in the premature closing of the slides. Any suitable locking device can be used.

- The pins, pulleys or rollers 5, 6 and 7 may be constructed in a variety of ways. In the case of apparatus which is light in weight, then the form shown in Figure 5A might be used, in which screw
125 20 holds a cylinder 21 on plate 4 and is secured by nut 29. Cylinder 21, which may be metal or a plastics material such as P.T.F.E. or nylon, may be flanged if desired. Alternatively, a metal cylinder 21 can be brazed, welded or riveted to plate 4. For more general application involving heavier
130

apparatus, then a pulley of the form shown in figure 5B is more suitable. Pulley 22 is mounted so that it is free to rotate on screw 20 which is fastened to plate 4 by nuts 29 and 29' and washer

- 5 23. For very heavy apparatus, a ball or roller bearing may be incorporated in the pulley, as shown in Figure 5C. Screw 20, secured by nuts 29 and 29' to plate 4, carries pulley 25 between washers 24 and 27. A roller bearing 26 or the like
10 is fitted to the centre of pulley 25. Alternatively, a smooth cylindrical pivot attached to plate 4 might be used, and the pulley 25 and bearing 26 secured to the pivot by means of a circlip or a split pin. Pulley 22 or 25 might also be shaped as pulley 28
15 in Figure 5D to ensure that it cannot run off the edge of support plate 1.

- Another suitable form for the rollers 5, 6, and 7 is illustrated in Figure 5E. In this embodiment the cheeks of the pulley 32 and 33 are threaded on mounting screw 20 which is in turn secured to
20 plate 4 by nut 39, so that cheeks 32 and 33 are fixed. Roller 31 is a clearance fit on screw 20 and is free to rotate between the cheeks 32 and 33. Various other forms of pulley or roller construction
25 are also possible and will occur to those skilled in the art.

- As mentioned above, when the apparatus is enclosed in a box or case, then plate 4 may conveniently form the side of the apparatus.
30 However, if an open chassis with no sides is to be mounted, then the plate 4 must be separately provided and attached to the chassis. Alternatively, pins 6 and 7 could be secured to the side of the chassis and pin 5 supported on a
35 suitably placed bracket. If a very thin chassis, or one consisting only of a flat plate is used, then it is of course possible to mount all three pins on brackets in place of the plate-like member 4.

- Support plate 1 is preferably made from steel plate which is thick enough to carry the weight of the apparatus without bending or distortion, but other materials may also be used. It can also be made an integral part of the sliding member of
40 telescopic slide 2 is desired.

- The precise location of the slots and notches in support plate 1 and the positions of the pins 5, 6 and 7 on plate 4 are shown relatively in Figures 6 and 7 respectively. Referring first to Figure 6, the distance between the centres of pins 6 and 7 is taken as x , and the position of pin 5 is defined in terms of y and z relative to the position of pin 6. The diameter of the pins or rollers is taken as p . The positions of the slots and notches in support
50 plate 1 in terms of these dimensions is given in Figure 7. Here the dimension d represents the distance through which it is desired to move the unit forward between the orientations shown in Figures 1 and 2, and e is the distance from the centre of the notch 14 to the front edge of support
60 plate 1. The diameter of all the notches, and the width of the slots, should obviously be slightly greater than p . The length of the tongue 13 must be greater than $(y + p)$ to ensure stability in the orientation shown in Figure 4, but the distance
65 from the rear end of slot 8 to the rear of tongue 13

- should not be less than y otherwise it will be difficult to obtain this orientation. The distance between notch 15 and the front of support plate 1 must be less than $(x - p)$ to allow the apparatus to be swung down into the third orientation (Figure 3), and pin 7 must be further than $(d + e)$ from panel 10 so that the normal position (Figure 1) can be obtained. The length of slot 8 must be greater than $(d + e + p)$ in order to allow the unit to be
70 moved forward sufficiently to allow pin 7 to clear the front end of support plate 1 when moving between the positions of Figures 2 and 3.

- Within these limitations, and those of the fixed dimensions shown in Figures 6 and 7, the sizes and positions of the pins and notches may be varied to suit a particular application. In general it is best to keep x and y and large as possible to ensure the best stability, but y is limited by the need to allow both pins 5 and 6 to enter slot 8, and, of course, by the height of the apparatus to be mounted.
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- It will be appreciated that it is within the scope of the invention to shape the support plates 1 to allow only some of the orientations described, and that the pins and notches may be repositioned to allow other orientations to be achieved (for example, one which supported the unit at 45° to the support plate), if these are considered to be more suitable for a particular application.
90

95. CLAIMS

1. A rack mounting system for securing electrical apparatus to a pair of telescopic slides or the like, comprising a pair of rigid elongated support plates forming part of or attached to the sliding members of the telescopic slides, said support plates being provided with a plurality of slots and notches opening into the upper edge of the plate, and positioned in such a way as to simultaneously receive and locate two out of a plurality of pins, pulleys or rollers carried by said electrical apparatus and said notches, slots and pins, pulleys or rollers being positioned so as to allow the said apparatus to be positioned in a plurality of orientations on said support plates
100 once the telescopic slides have been extended, and maintained in these orientations through the action of gravity so that the apparatus can only be moved from the selected orientation by a deliberate lifting action, thereby improving access
105 to the apparatus whilst it remains on the telescopic slides, but allowing the easy removal of the apparatus from the slides in at least one of the orientations simply by lifting the said pins or the like out of the said slots and notches.
2. A rack mounting systems as claimed in claim 1 wherein said pins, pulleys or rollers are provided with flanges to prevent the support plates from moving away from the electrical apparatus.
120
3. A rack mounting system as claimed in claim 1 or 2 wherein the positions of the said pins or the like and said notches and slots are arranged so that the various orientations of the apparatus can be obtained in sequence simply by lifting the front of the apparatus so that it remains supported on
125

only one pair of pins and rollers, and then moving it so that these pins or rollers slide along an edge of the support plate into the next desired location.

4. A rack mounting system as claimed in claim 5 1, 2 or 3 wherein the electrical apparatus is provided with side plates and the pins or the like are mounted on the side plates.

5. A rack mounting system as claimed in any preceding claim wherein the electrical apparatus 10 has a front and rear and two sides and carries on each side at least three pins, pulleys or rollers, two of the pins or the like being positioned in substantially the same horizontal plane and a third being positioned higher and nearer to the 15 rearward one of said two pins of the like than to the forward one.

6. A rack mounting system as claimed in any preceding claim wherein each support plate has a generally horizontal top edge formed with a 20 substantially horizontal slot opening upwardly at its rear and terminating at its blind front end in a downwardly formed notch for retaining a pin or the like under the action of gravity, and three downwardly formed notches positioned in front of 25 the slot.

7. A rack mounting system as claimed in claim 6 wherein the first of the three notches taken in order from the rear to the front of the plate is deeper than the other two.

30 8. A rack mounting system as claimed in claim 6 or 7 wherein the rearward edge of the first of the three notches taken in order from the rear to the front of the plate is formed as a rearwardly and upwardly inclined ramp from the notch up to a 35 raised edge above the slot, along which ramp and edge a said pin or the like may run.

9. A rack mounting system as claimed in any preceding claim wherein the electrical apparatus is provided at its front and/or rear with releasable 40 devices adapted to engage the rack and positioned to raise the apparatus to relieve the weight on the pins or the like in the stored position.

10. A rack mounting system as claimed in any preceding claim including a respective guide fitted 45 in the rack above each support plate to limit the upward movement of the electrical apparatus.

11. A rack mounting system substantially as hereinbefore described with reference to the 50 accompanying drawings.

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